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A MEASURED DROP METHOD OF APPLYING LIQUID INSECTICIDES

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The method of applying measured drops of liquid insecticides to individual insects has frequently been used. Nelson et al.1/ describe a method using micropipettes that, when filled, hold a test dose for a single housefly. Smith2/ uses a cactus spine to apply small quantities of oil to the spiracles of scale insects. Woodbury and Barnhart3/ describe a method utilizing a micropipette that holds sufficient insecticide to treat a number of bedbugs. The dose for the individual bug is delivered by air pressure.

The apparatus described here is diagrammed in figure 1. A metal hypodermic needle (F) is attached by DeKhotinsky cement to a 0.2-ml. pipette (C), which is subdivided into one-thousandths of a ml. The upper end of the pipette is attached to glass tubing, which leads through a stopcock (B) to a reservoir (A) for rinsing and to a microinjector (G) that will deliver small drops of liquid.4/ When the hypodermic needle is to be attached to the tip of the pipette, clogging is prevented by inserting a fine wire through the needle and into the pipette and leaving it there while the melted cement is being applied.

1/ Nelson, F. C., H. E. Buc, N. A. Sankowsky, and M. A. Jernakoff. A new method for evaluating the relative toxicity of a liquid insecticide. Soap 10 (10): 85, 87, 89, 91, 105, 107. Oct. 1934.

2/Smith, Ralph H. Microtechnique method of testing oil insecticides on scale insects. Jour. Econ. Ent. 31 (5): 632-633. Oct. 1938.

3/Woodbury, E. N., and C. S. Barnhart. Tentative methods for evaluating liquid household insecticides against the German cockroach and the bedbug. Soap 15 (9): 93, 95, 97, 99, 101, 103, 105, 107, 113. Sept. 1939.

4/The authors are indebted to C. S. Wilson, of the Bureau of Entomology and Plant Quarantine, for suggesting the use of this type of microinjector.

Figure 2 is a photograph of the apparatus in operation. The glass tube is joined to the microinjector with beeswax. Joints in the glass tubing and where the pipette joins the glass tubing are made of rubber tubing covered over and sealed with beeswax. The glass is brought together as close as possible inside the rubber tubing. This method makes a tight seal and also allows slight flexibility, which DeKhotinsky cement does not permit. The entire system must be entirely free of leaks to operate satisfactorily. The entire apparatus is securely fastened to a wooden base by wood screws, as shown in figure 2.

The whole apparatus is completely filled with distilled water before any insecticide is drawn into the pipette. If appreciable amounts of air are left in the microinjector or the tube connecting it with the pipette, the delivery of insecticide at the point of the needle will not be at a uniform rate. When the microinjector crank is turned to force the insecticide out of the needle, any considerable volume of air (1 or more ml.) will be compressed by the surface tension of the liquid across the very small opening in the tip of the needle. When this pressure becomes great enough to stretch this surface, a drop is formed on the tip of the needle. However, the slightly compressed air in the apparatus expands as much as possible at this time, and this expansion often results in a larger drop of insecticide forming on the tip of the needle than is desired. Also, owing to further expansion of the air, additional material may come out of the pipette when the drop is removed. For this reason distilled water, or some other relatively noncompressible material that will not appreciably affect the toxicity of the insecticide, should be used in the microinjector and the tube connecting it with the pipette.

Operation of Apparatus

After the apparatus below the stopcock has been filled with distilled water the microinjector plunger is screwed completely in. Turning the crank shown in figures 1 and 2 in a clockwise direction moves it to the left until it rests against the body of the injector. Any water on the tip of the needle is wiped off. The microinjector plunger is then withdrawn slightly by making two turns of the crank in a counterclockwise direction. This allows a small amount of air to enter the needle. The tip of the needle is then submerged in the insecticide, and the plunger is withdrawn by rotating the crank until the desired quantity of insecticide is drawn into the pipette. The air drawn into the needle forms a bubble about 3 mm. long (D in fig. 1) in the pipette between the water and the insecticide (E). The level of the insecticide is then read on the pipette. The scale on the board is used only for approximate readings. The microinjector crank is then turned in a clockwise direction until the desired quantity of insecticide has been delivered on the tip of the needle. The insect is then brought into contact with the drop of insecticide.

If the insecticide has the right properties, it will immediately spread over the integument of the insect. Volumes of liquid of one-half of one-thousandth of a ml. or larger can be measured and applied to the insects with a pipette of this size.

To rinse the apparatus with distilled water, open the stop-cock (B in fig. 1) and allow the water to flow through the pipette until it is thoroughly rinsed.

The apparatus does not need any parts especially made for it, and consequently it could be modified to fit the needs of the user. A pipette of smaller bore would allow accurate readings of smaller quantities. A glass tip on the pipette could be substituted for the metal one, to allow the use of cleaning fluid for removing insecticidal residues which cannot be removed by noncorrosive solvents.

Active insects may be held in the hand as shown in figure 2, placed in small cages, chilled to immobilize them, or anesthetized while the insecticide is being applied. Many slow-moving insects, such as some lepidopterous larvae, may be treated during normal activity.

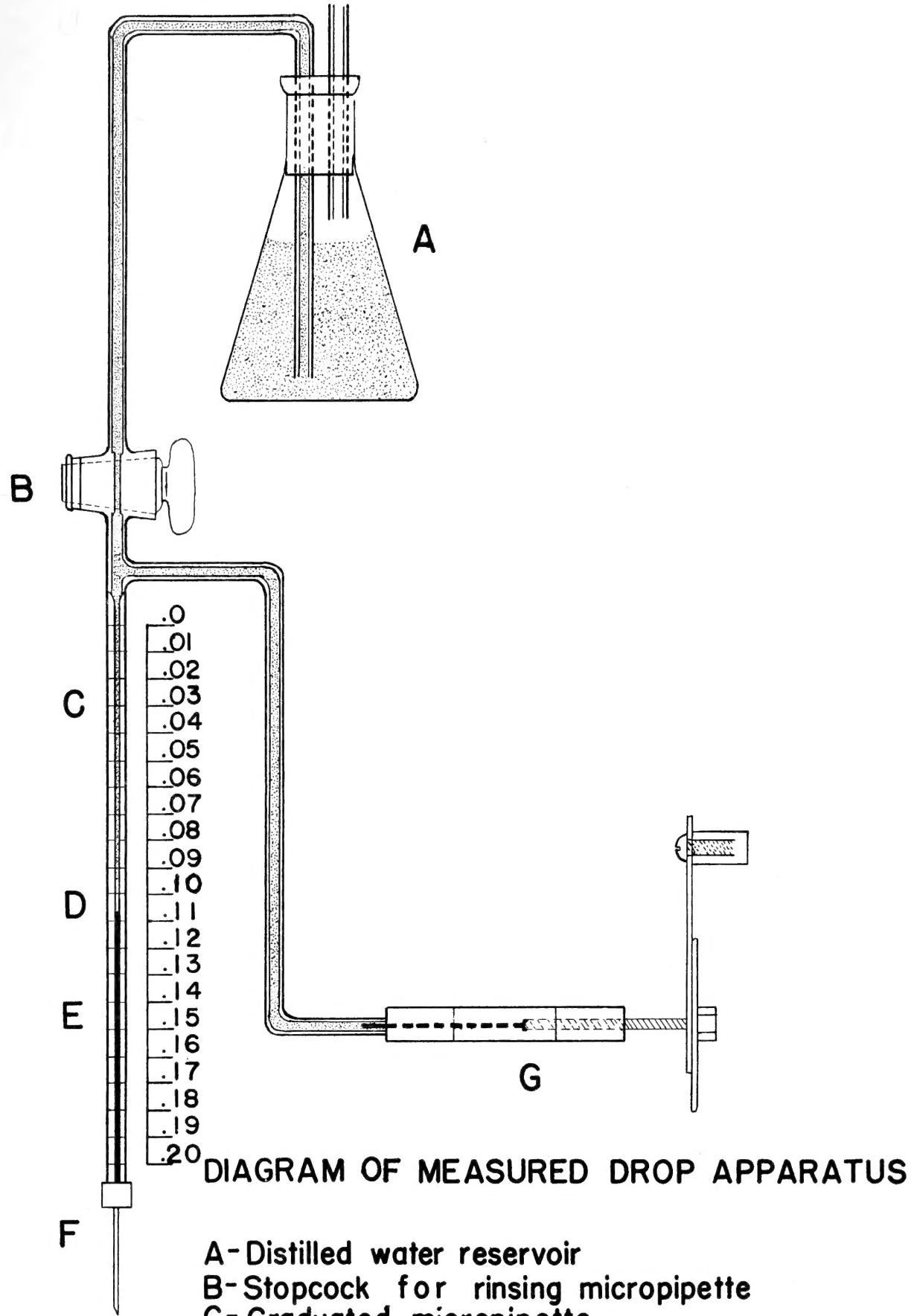

Figure 1.--Diagram of apparatus for applying measured drops of liquid insecticides to insects.

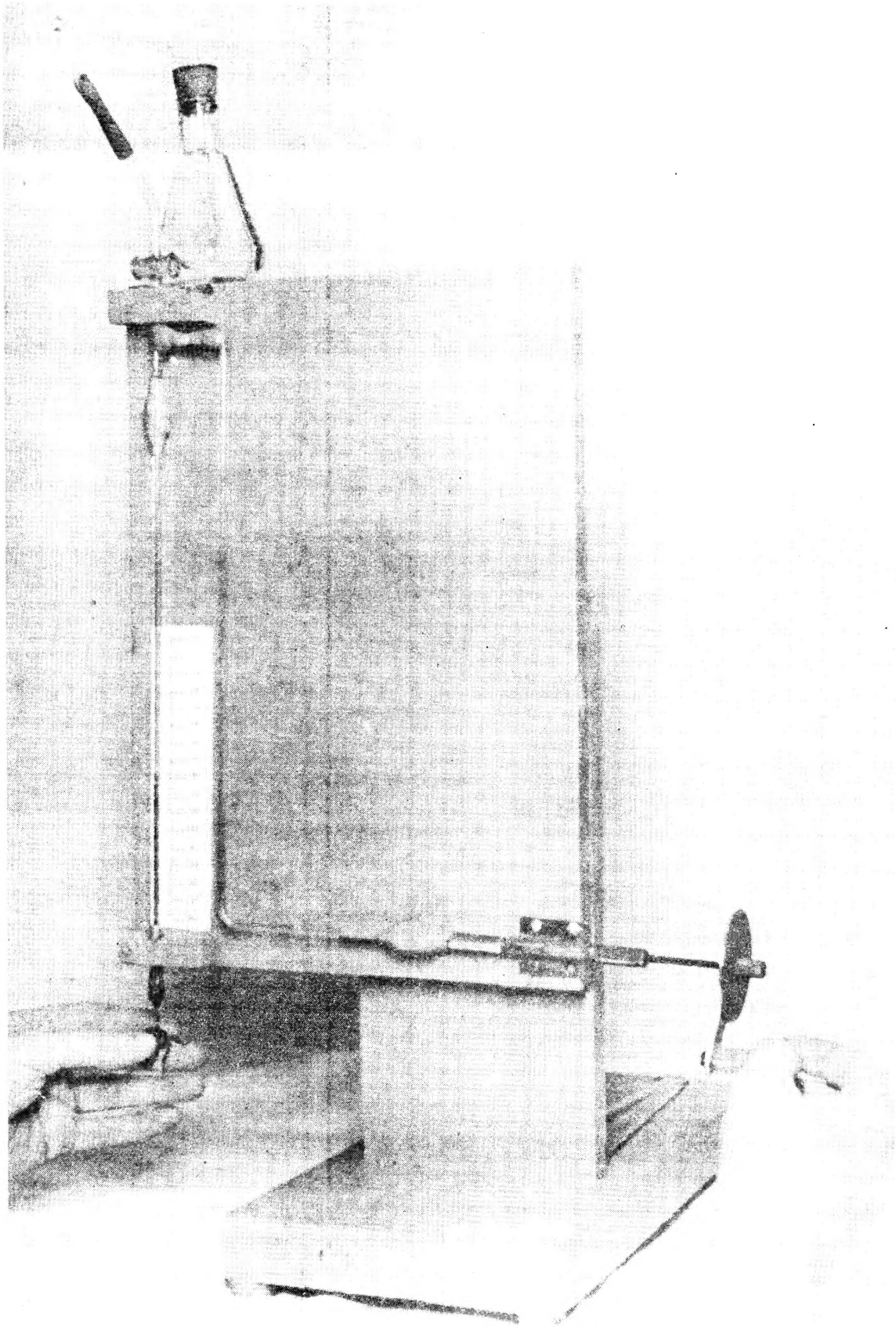

Figure 2.--Photograph showing operation of apparatus for applying measured drops of insecticide to the integument of insects.